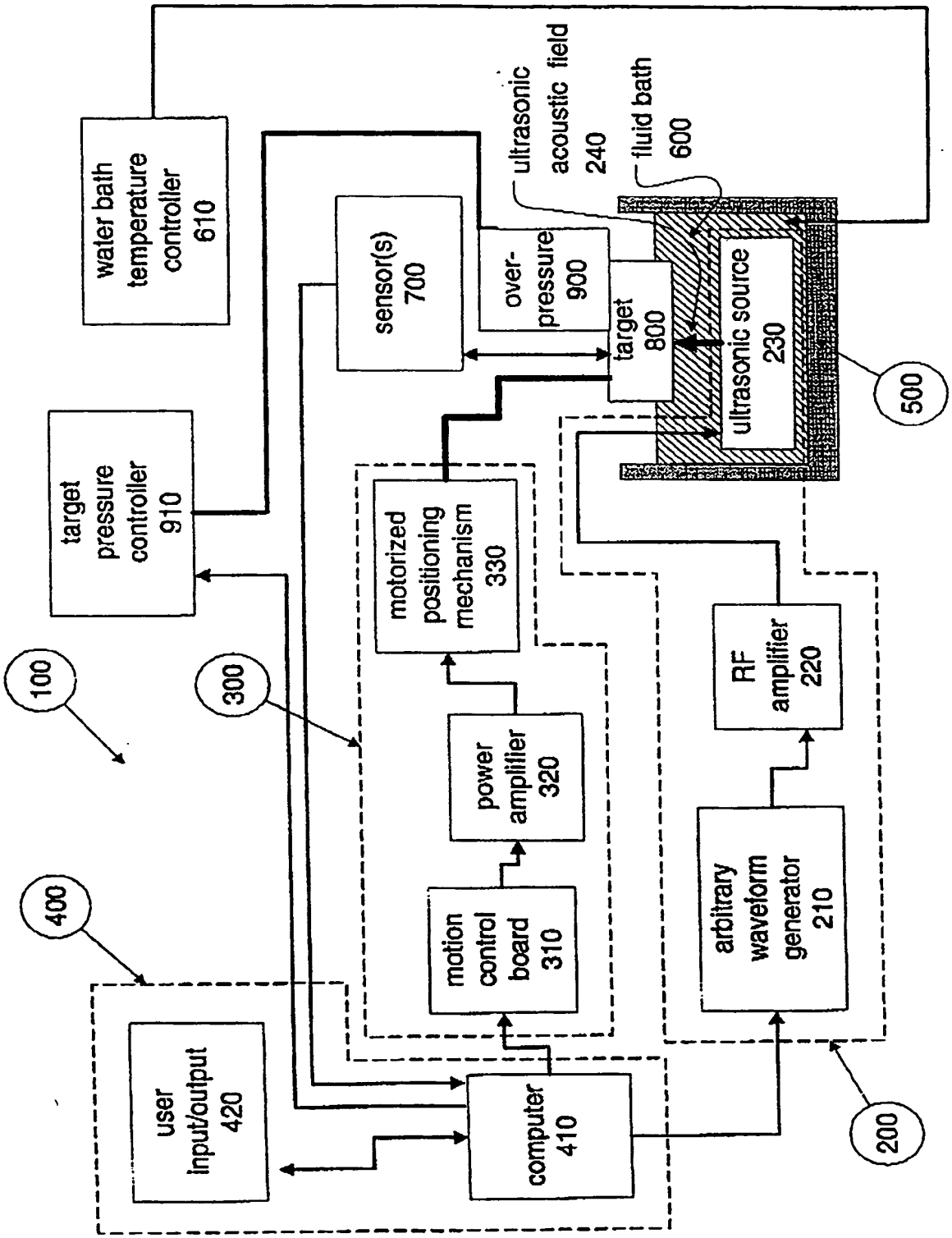
water bath temperature controller 610
ultrasonic acoustic field 240
fluid bath 600
sensor(s) 700
over-pressure 900
target 800
ultrasonic source 230
500
target pressure controller 910
motorized positioning mechanism 330
RF amplifier 220
100
300
power amplifier 320
400
motion control board 310
arbitrary waveform generator 210
user input/output 420
computer 410
200

Figure 1

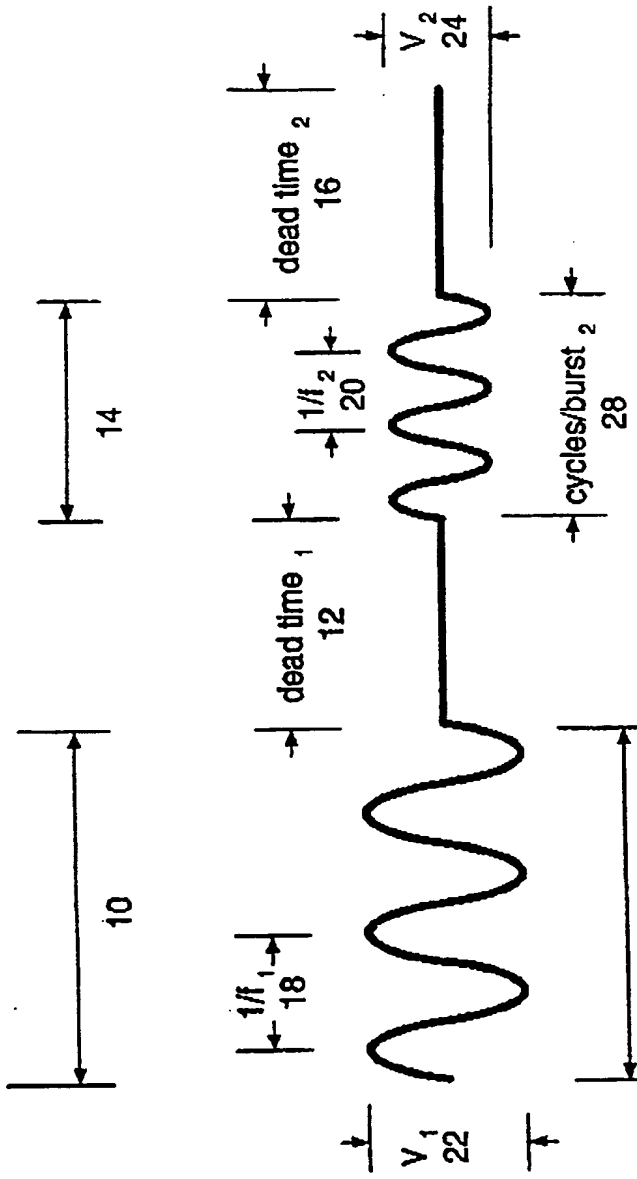
10
14
dead time 1
12
dead time 2
16
1/f1
18
1/f2
20
V1
22
V2
24
cycles/burst 1
26
cycles/burst 2
28

Figure 2

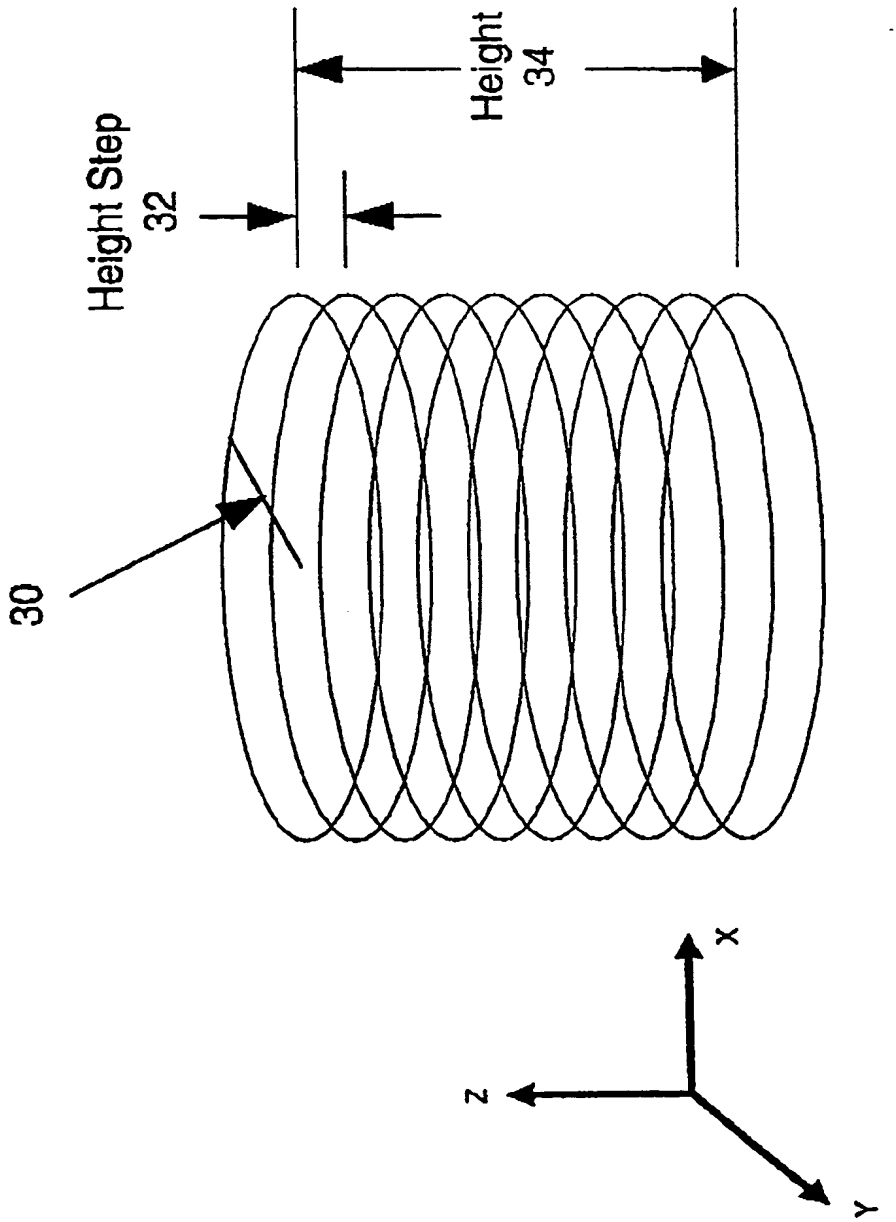

Figure 3

WO 00/25125 PCT/US99/25274

09/830473

treatment vessels

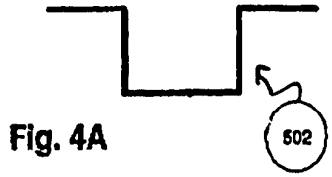

Fig. 4A

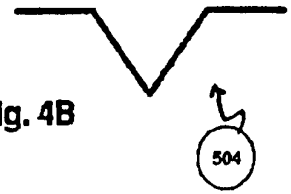

Fig. 4B

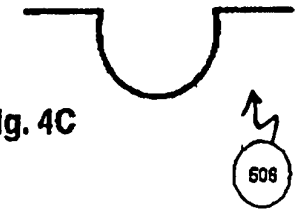

Fig. 4C

pre-treatment assembly

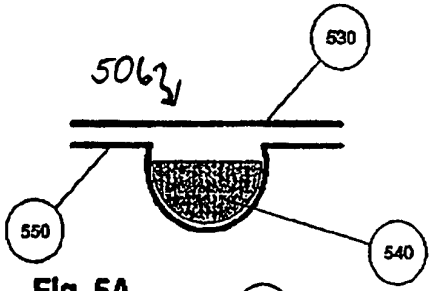

Fig. 5A

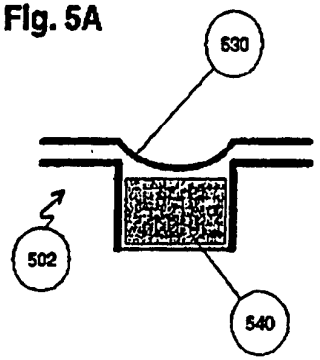

Fig.5B

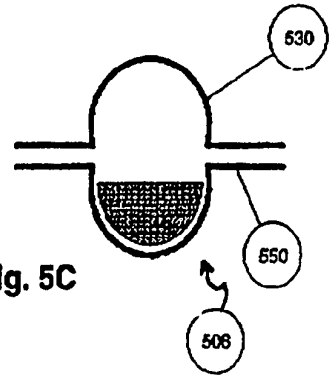

Fig. 5C

post-treatment transfer

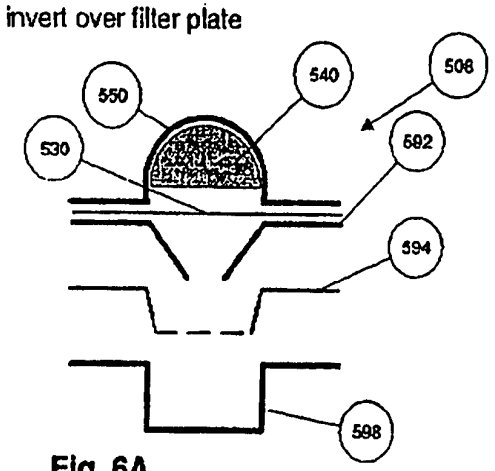

Fig. 6A

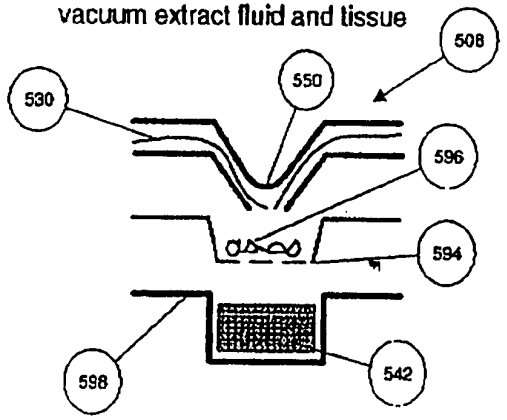

Fig. 6B

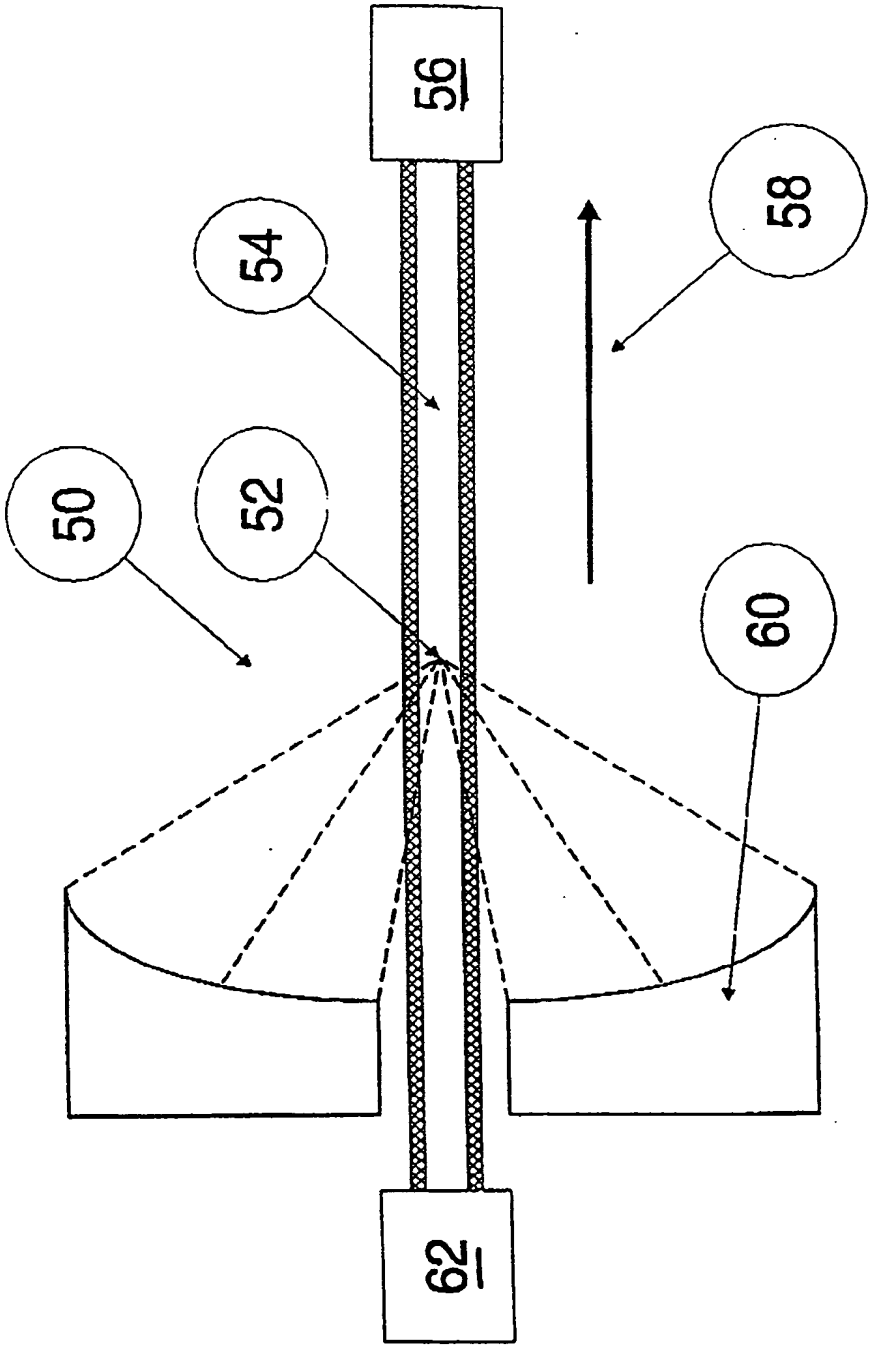

Figure 7

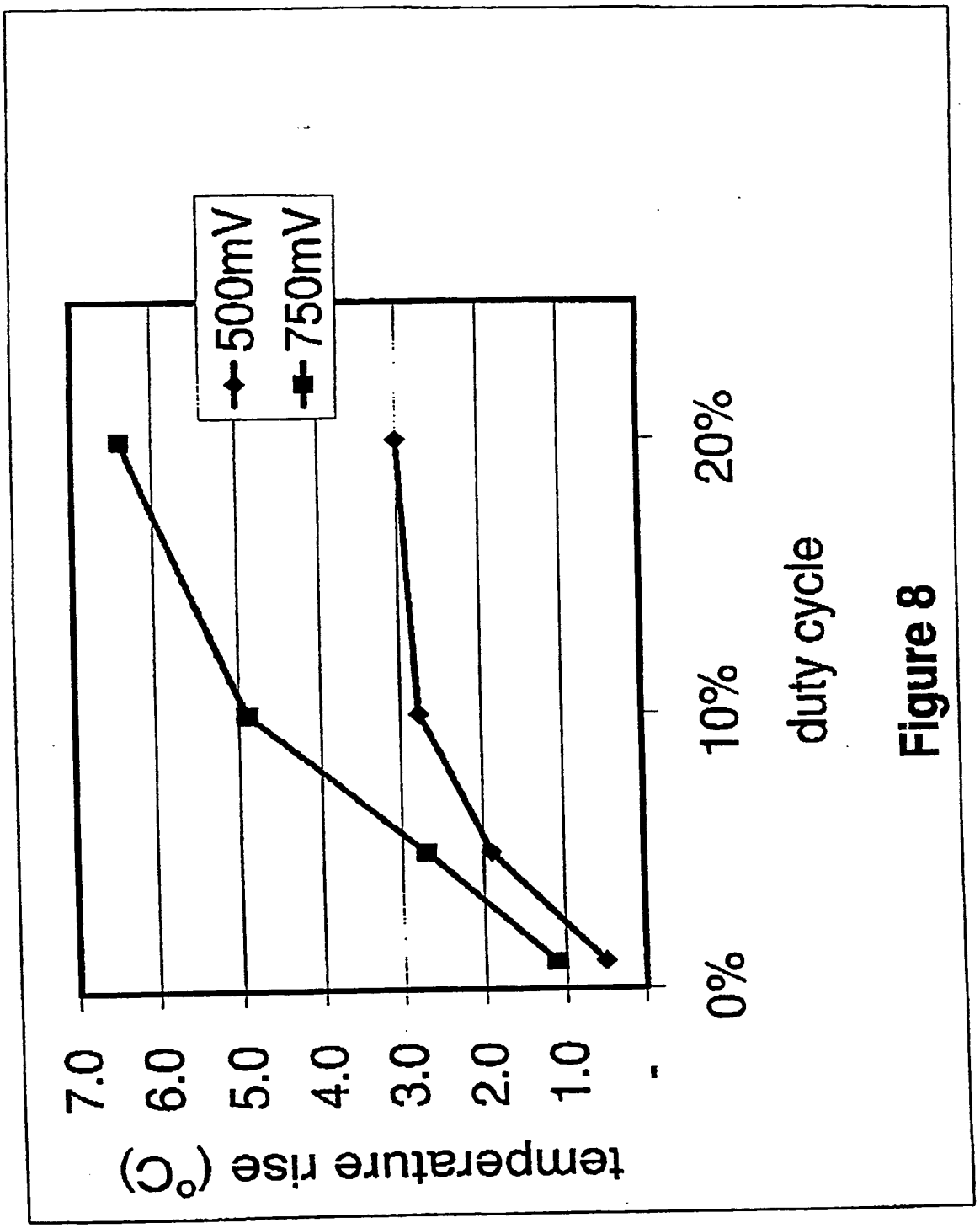
500mV
750mV
temperature rise (°C)
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0%
10%
20%
duty cycle

Figure 8

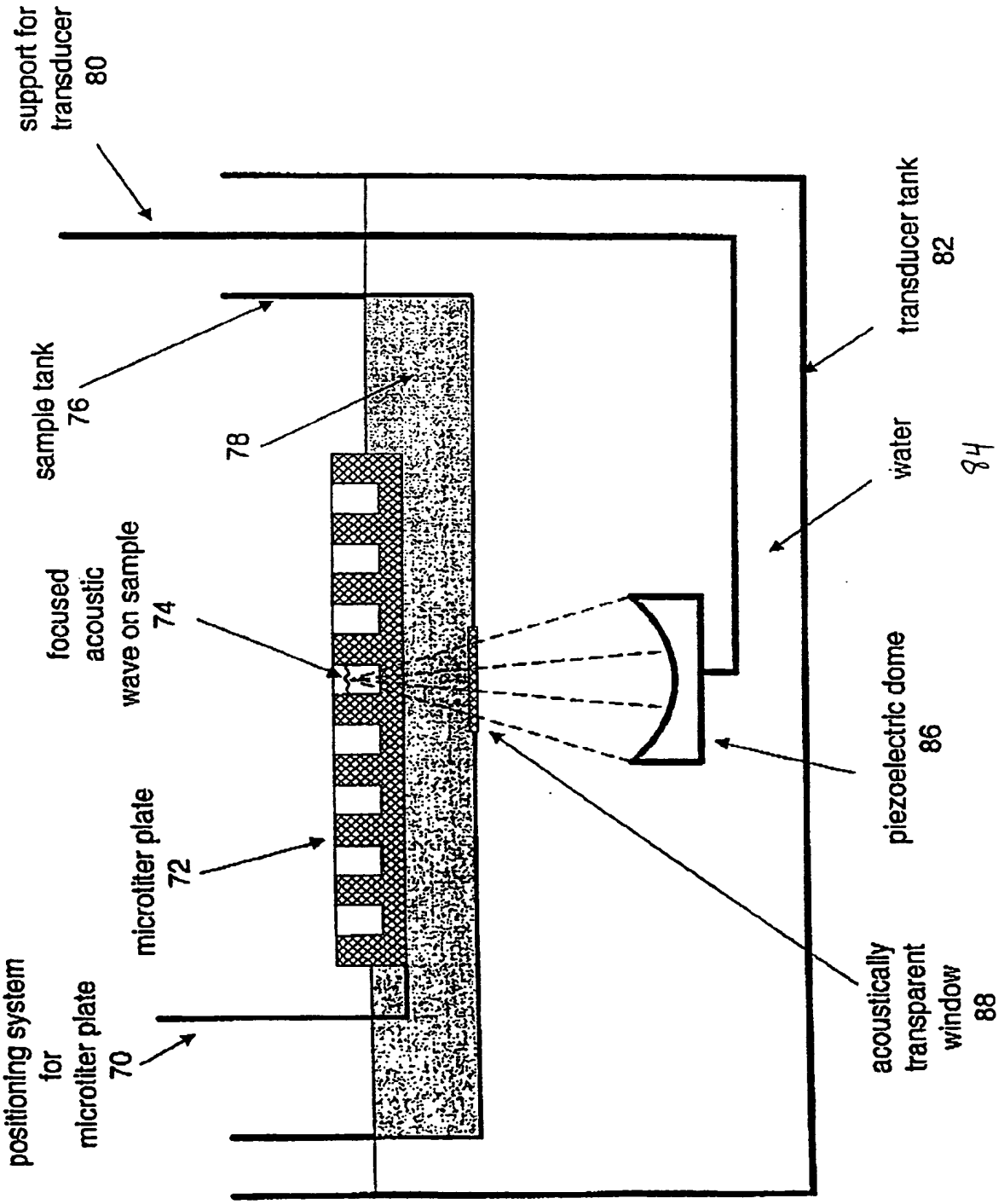
support for transducer 80
sample tank 76
78
focused acoustic wave on sample 74
microliter plate 72
positioning system for microliter plate 70
transducer tank 82
water 84
piezoelectric dome 86
acoustically transparent window 88

Figure 9

Figure 16

SYSTEM SPECIFICATIONS		EXTRACTION	TRANSFORMATION	RESEARCH
PERFORMANCE:				
Format		microtiter	microtiter	variable
Treatment time		50 sec per well		variable
Temperature				
	bath temp control	+4 to +25C	+4 to +40C	-10 to +40C
	Sample temp rise	<4C	variable	variable
Acoustic parameters				
	Frequency	1.1 MHz	1.1MHz	1.1,3.3MHz
	Treatment profile			
	Acoustic Waveform	shock	sine, shock	sine, shock
	acoustic mask under plate			
Traverse time between samples		2 sec	2 sec	variable
Atmosphere Control		none	gas, overpressure	gas, overpressure
CONSUMABLE:				
	Format	96well PCR plate, off-the-shelf	24 well plate	variable
	Volume	200ul standard. Other options	variable	
	single use?	yes	yes	single and multi
	Sterile	optional	yes	optional
PROCEDURE:				
		transfer to plate	aliquot cell culture into plate	
		add fluid	treat at controlled temperature	
		heat seal plate	transfer to growth medium	
		store at -80C		
		treat at +4C		
		place on vacuum fixture		
		vacuum transfer to microtiter		
		option: filter at transfer		
MECHANICAL:				
Format		benchtop plus half-rack and chiller	benchtop plus half rack	cart plus rack
Water Bath				
	Water volume	1 gal distilled water	1 gal distilled water	15 gal
	temperature control			
	circulation pump			
	degassing system			

Figure 11

System Specifications

		EXTRACTION	TRANSFORMATON	RESEARCH
INSTRUMENT CONTROL: LabVIEW				
x-y-z positoning (sample)		yes	yes	yes
z' axis (transducer)		manual, 25mm range	manual, optional auto	manual
Temperature feedback to protocol		yes	yes	yes
partial treatments		yes	optional	no
cavitation detection				yes
video detection and analysis		no	optional	yes
USER INTERFACE: LabVIEW				
treatment protocol		fixed	user adjustable	flexible
select treatment positions		pre addressed	user adjustable	flexible
temperature profile record		optional	yes	yes
timing information		yes	yes	yes
ELECTRICAL:				
Power: 110V, 20A				
EQUIPMENT:				
Chiller		yes	no	yes
RF Amplifier		yes	yes	yes
Arbitrary waveform generator		yes	yes	yes
oscilloscope		no	optional	yes
Computer		yes	yes	yes
motion control		yes	yes	yes
	I/o boards			
	amplifier			
	xy stage			
IR temperature measurement		yes	yes	yes
video		no	optional	yes
laser sight/cross-hairs		yes	yes	yes
vacuum fixture		yes	no	no
Transducer				
matching network				
cables				
circulation pump				
convection cooling				
filter				
cavitation detection		no	optional	yes

Figure 12

LabVIEW PROGRAMMING TASKS

	Extraction	Transformation
GENERAL		
display revision level	x	x
safety interlocks	x	x
time and date stamp		x
STOP function	x	x
save configuration to file	user can reset defaults	x
operating parameters		x[F]
protocol		x
save data to file		
treatment postions and protocols		x
temperature profile		x
error conditions		x
password protection on Vis	x	x
load configuration from file		x
user selects treatment positions	x	x
DISPLAY		
User selectable treatment positions -graphical	x	x
current status		
treatment position -graphical	x	x
current protocol	by name	x
-voltage		x
-duty cycle		x
-etc		x
time to finish current sample	x	x
safety interlock status	x	x
sample temperature, graph and current temp		x
time and date		x
ULTRASONICS		
initialize instrument(s)	x	x
stop function	x	x
mix and treat	predetermined	userprogrammable
frequency	predetermined	x
voltage-treat	predetermined	x
voltage-mix		x
pulselength-treat	predetermined	x
pulselength-mix		x
deadtime-mix>treat		x
deadtime-treat>mix		x
Total cycles (or time)	predetermined	x
cavitation detection		optional
POSITIONING		
setup and diagnostics		
initialize stepper control board	x	x
calibrate (home)	x	x
check limits (limit switches)	x	x

LabView Programming Tasks

	Extraction	Transformation
POSITIONING		
setup and diagnostics		
program sample positions	predetermined	predetermined
program dithering	predetermined	x
operation		
select sample format	predetermined	
select treatment positions	predetermined	x
select treatment for each position	x	x
select dithering profile	on/off only	x
stop at limits	x	x
TEMPERATURE		
measure temperature		x
display temperature		
momentary		x
graph		x
record temperature		x
current temperature		x
record min/max		optional
save to file		optional
manage process based on temperature		
pause process to cool		
modify process		
go to next well at set temperature rise		

Figure 13